

## DERMAL HEMANGIOSARCOMA IN A SUGAR GLIDER (*PETAURUS BREVICEPS*)

Anne E. Rivas, DVM, Geoffrey W. Pye, BVSc, MSc, Dip. ACZM, and Rebecca Papendick, DVM, Dip. ACVP

### Abstract

An 11-year-old female sugar glider (*Petaurus breviceps*) was presented with a rapidly growing dermal mass at the lateral margin of the right patagium. The result of a biopsy was consistent with a dermal hemangiosarcoma, and findings of histopathologic examination of the abnormal tissue confirmed the tentative diagnosis following surgical excision of the mass. At 1 year postsurgery, there was no evidence of local recurrence or metastatic disease. There are published reports of sugar gliders diagnosed with neoplasia, and oncology cases affecting this species are occasionally seen in clinical practice. Based on an extensive literature search, the authors believe this is the first report of a dermal hemangiosarcoma in a sugar glider. Copyright 2014 Published by Elsevier Inc.

**Key words:** dermal hemangiosarcoma; dermal lesion; neoplasia; *Petaurus breviceps*; sugar glider

**A**n 11-year-old, 68 g, intact female sugar glider (*Petaurus breviceps*) was presented for evaluation of a small area of erythema on the lateral margin of the right patagium. The patient was housed with one other sugar glider in a 91 × 61 × 61-cm<sup>3</sup> enclosure and fed a commercial parrot diet (Red Apple Paradise; Scenic Bird Food, Plymouth, MN USA), supplemented with fresh fruits and insects. The animal was part of a zoological collection, with the diet having been formulated to adequately meet the nutritional needs of a sugar glider by the institution's nutritionists.

At presentation, the patient was not exhibiting any overt clinical signs of illness and no other abnormalities were detected on physical examination. The lesion on the right patagium was mildly thickened and 2 mm in diameter. The examiners believed the animal may have had a small traumatic insult to the right dorsal patagium; therefore, a decision was made to monitor the lesion for a change in size or appearance.

The area was noted to be 4 mm in diameter 4 days later, at which time the glider was anesthetized for further diagnostics. Inhalant isoflurane (IsoFlo; Abbott Laboratories, North Chicago, IL USA) in 100% oxygen was

administered via facemask for induction and maintenance of anesthesia. Heart rate (185 beats per minute) and respiratory rate (60 breaths per minute) were within normal limits, although a sinus rhythm was detected on thoracic auscultation. There were multiple, prominent blood vessels evident near the lesion on the right patagium. Impression smears and fine-needle aspirates of the lesion were not diagnostic; however, mild hemorrhage from the lesion was noted following fine-needle aspirate attempts.

While still under general anesthesia, lateral and dorsoventral survey radiographs were obtained, and they revealed a soft tissue density at the site of

From the Department of Veterinary Clinical Medicine, University of Illinois College of Veterinary Medicine, Urbana, IL USA; and the San Diego Zoo, San Diego, CA USA.

Address correspondence to: Geoffrey W. Pye, BVSc, MSc, Dip. ACZM, Disney's Animal Kingdom, Department of Animal Health, 1200 N Savannah Circle, Bay Lake FL 32830. E-mail: [Geoffrey.W.Pye@disney.com](mailto:Geoffrey.W.Pye@disney.com).

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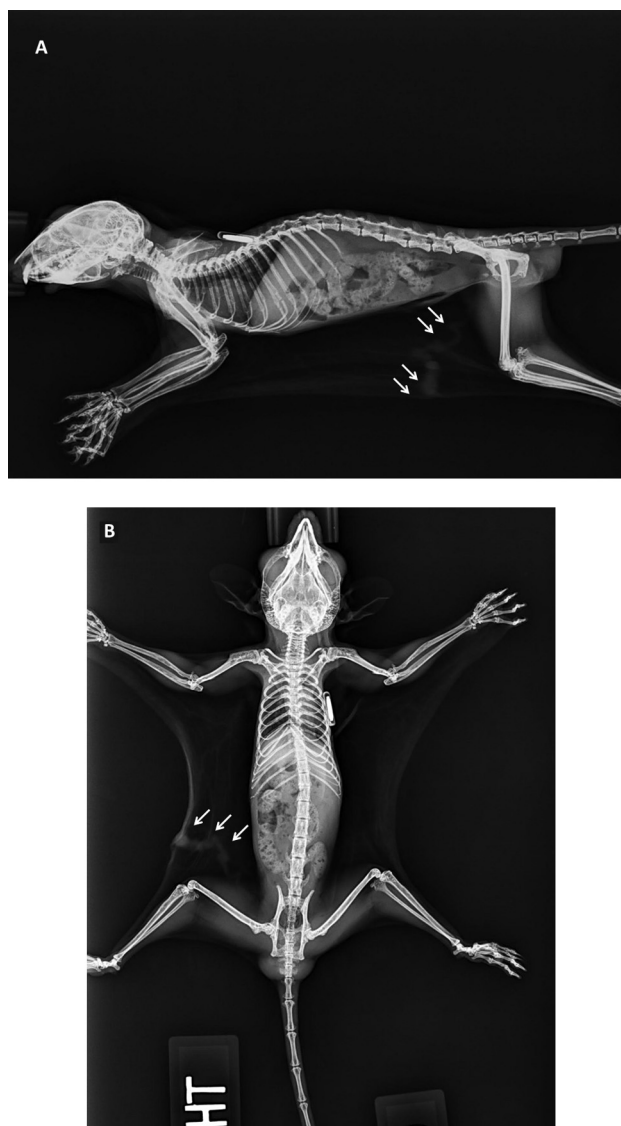
the lesion with evidence of engorged blood vessels emanating from the lesion (Fig. 1). A drop of blood was collected from the saphenous vein and the blood smear was submitted for a complete blood count. The results of the complete blood count were within normal limits for sugar gliders.<sup>1</sup>

After receiving the diagnostic test results, the lesion was considered to be an infected wound. The sugar glider was hospitalized to monitor the wound and for treatment with meloxicam (0.2 mg/kg, orally, every 24 hours, for 10 days, Metacam; Boehringer Ingelheim, St. Joseph, MO USA) and trimethoprim-sulfamethoxazole (15 mg/kg, orally, every 12 hours; Hi-Tech Pharmacal Co., Amityville, NY USA).

The sugar glider continued to demonstrate normal appetite and behavior while in the hospital, but, 9 days after the initial presentation, the lesion appeared to be increasing in size. The glider was anesthetized as previously described, and a full-thickness biopsy of the patagium was taken at the site of lesion using a 2-mm biopsy punch (Milrex Inc., York, PA USA). A full excisional biopsy was not pursued initially as preliminary biopsy results were desired to guide definitive therapy, including appropriate surgical margins.<sup>2,3</sup> The biopsy site was closed with 2 simple interrupted polydioxanone sutures (6-0, PDS II; Johnson & Johnson, Somerville, NJ USA).

The findings of the histopathologic evaluation of the biopsy sample was consistent with a dermal hemangiosarcoma. The dermis was expanded by a poorly demarcated invasive neoplastic mass composed of clefts and small blood-filled vascular spaces lined by single, or occasionally multiple, layers of flattened to plump neoplastic spindle cells. Vascular spaces dissected between collagen bundles and separated muscle fiber bundles in the panniculus (Figs. 2 and 3).

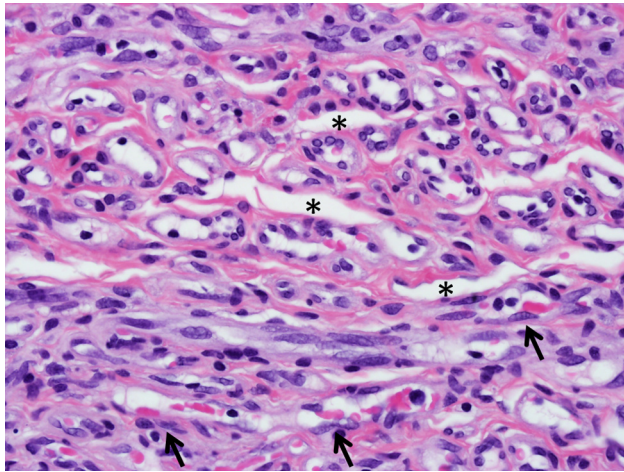
Based on the biopsy results, surgical excision of the neoplastic mass was performed. The glider was administered midazolam (0.1 mg/kg intramuscularly; Bedford Laboratories, Bedford, OH USA), buprenorphine (0.01 mg/kg intramuscularly, Buprenex; Reckitt Benckiser Pharmaceuticals Inc., Richmond, VA USA), and meloxicam (0.2 mg/kg intramuscularly) for premedication, and then induced and maintained on inhalant isoflurane in oxygen as previously described. Compared with the previous anesthetic events, there was significant postoperative sedation for the surgical procedure to reduce the occurrence of postsurgical mutilation that is common in this species.<sup>1</sup> To decrease skin irritation, and as a result postsurgical mutilation, preparation of the surgical



**FIGURE 1.** Left lateral (A) and ventrodorsal (B) radiographic views of an 11-year-old female sugar glider with a lesion on the right lateral patagium. Engorged blood vessels are evident as they radiate from the lesion (arrows).

site was performed with 0.9% sodium chloride (Sodium Chloride Irrigation, USP; Hospira Inc., Lake Forest, IL USA) alone.

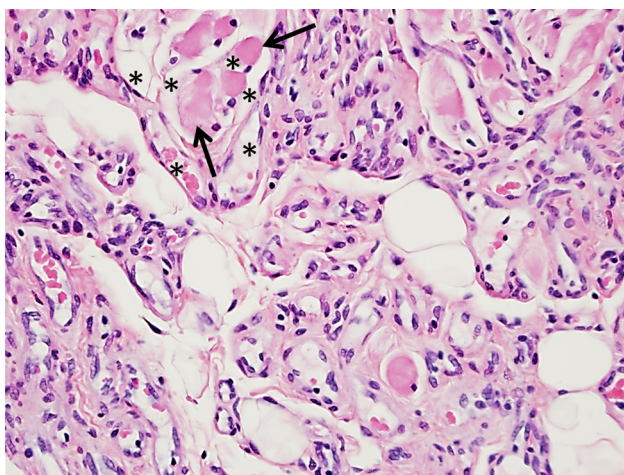
A temporary ligature of 6-0 polydioxanone was placed through the skin around a major blood vessel of the tumor close to the body wall. Radiosurgery (Surgitron; Ellman International, Oceanside, NY USA) was used to incise through both layers of the patagium, excising the tumor with adequate tissue margins. The incision was extended up the distended vessel to within 4 mm of the body wall; the vessel was then ligated with 6-0 polydioxanone and transected. After observing the area to ensure no further hemorrhage, the patagium was closed with 6-0 polydioxanone in 2



**FIGURE 2.** Photomicrograph (hematoxylin-eosin staining;  $\times 600$ ) of a biopsied dermal mass from the right lateral patagium of an 11-year-old female sugar glider. The findings were consistent with a dermal hemangiosarcoma and showed the mass was composed of disorganized clear clefts (asterisks) and small occasionally blood-filled vascular spaces lined by one or more layers of plump spindle-shaped cells (arrows).

layers using an internal-facing simple continuous pattern.

The excised mass was submitted for histopathologic evaluation of the tissue and assessment for clean tissue margins. As with the previous biopsy results, the surgery samples were consistent with a dermal hemangiosarcoma. The examined section contained a focal, poorly demarcated, moderately cellular mass that replaced and transmurally mildly expanded the patagium. The mass was variably composed of haphazard streams of plump spindle cells often



**FIGURE 3.** Photomicrograph (hematoxylin-eosin staining,  $\times 400$ ) from the same biopsy specimen as Figure 2 showing neoplastic vessels (asterisks) invading around and separating muscle bundles and isolating individual myofibers (arrows) at the periphery of the lesion.

lining irregular, blood-filled clefts or channels and clusters of well-differentiated small vascular spaces. In the clefts, skeletal muscle fibers were entrapped and separated by these spindle cell proliferations; 1 mitotic figure per high-power field was noted. The margin with the large blood vessel was free of tumor, though it was more difficult to determine if clean lateral margins had been obtained elsewhere. It was recommended to monitor the site for any evidence of recurrence.

Postoperative care consisted of enrofloxacin (10 mg/kg, orally, every 24 hours for 7 days, Baytril; Bayer, Shawnee Mission, KS USA) and meloxicam (0.2 mg/kg, orally, every 24 hours for 4 days). The glider was maintained in hospital for continued observation of the surgery site. At 11 days after surgery, and 28 days after initial presentation, the surgical site was completely healed with no evidence of tumor reoccurrence at the surgical site. The glider was released from medical treatment and allowed access to a conspecific. At the 1-year follow-up, there was no local or systemic sign of disease.

## DISCUSSION

Sugar gliders are arboreal, nocturnal marsupials that have been maintained in zoological collections for many years, and in the past 2 decades have become more popular in the pet trade. Although individual case reports are limited to instances of a transitional cell carcinoma, a cutaneous lymphosarcoma, and a bronchoalveolar carcinoma, several groups have undertaken surveys of sugar glider pathology records in an attempt to better ascertain the types of neoplasia that occur within this species.<sup>4-9</sup>

These reviews indicate a diverse variety of neoplasm types and locations in gliders (Table). Adenocarcinoma (22% of cases) was the most commonly reported tumor type, followed by lymphosarcoma (12% of cases). There were also trends in the locations of neoplastic growth. Among reported cases, 10% were hepatocellular tumors, 14% were mammary tumors, and 18% were tumors of the skin and subcutaneous tissues, including the sugar glider described in this case report.

The dermal location of the hemangiosarcoma in this case is likely associated with the lack of metastatic disease even 1 year following the original diagnosis. In domestic dogs and cats, pure cutaneous or dermal hemangiosarcoma without any subcutaneous infiltration has a low rate of metastasis.<sup>10,11</sup> Conversely, subcutaneous and



TABLE. Reported neoplasms of sugar gliders

Case	Sex	Age <sup>a</sup>	Diagnosis	Source
1	– <sup>b</sup>	–	Transitional cell carcinoma (lower urinary tract)	Garner <sup>8</sup>
2	M	10	Transitional cell carcinoma with squamous cell differentiation (pericloacal)	Marrow et al. <sup>7</sup>
3	F	7	Squamous cell carcinoma (vaginal)	Gentz et al. <sup>9</sup>
4	F	A <sup>c</sup>	Carcinoma (adrenal cortical)	Gentz et al. <sup>9</sup>
5	M	11	Carcinoma (intestinal)	Gentz et al. <sup>9</sup>
6	F	A	Carcinoma (bronchoalveolar)	Junge and Sundberg <sup>6</sup>
7	F	4	Carcinoma (mammary)	Gentz et al. <sup>9</sup>
8	F	6	Carcinoma (mammary)	Gentz et al. <sup>9</sup>
9 <sup>1</sup>	–	–	Adenocarcinoma (mammary)	Garner <sup>8</sup>
10	–	–	Adenocarcinoma (mammary)	Garner <sup>8</sup>
11	–	–	Adenocarcinoma (mammary)	Garner <sup>8</sup>
12	–	–	Adenocarcinoma (mammary)	Garner <sup>8</sup>
13	–	–	Adenocarcinoma (mammary)	Gentz et al. <sup>9</sup>
14	–	–	Adenocarcinoma (chest gland)	Gentz et al. <sup>9</sup>
15	–	–	Adenocarcinoma (metastatic)	Gentz et al. <sup>9</sup>
16	F	7	Adenocarcinoma (lung)	Gentz et al. <sup>9</sup>
17	F	A	Adenocarcinoma	Gentz et al. <sup>9</sup>
18	M	10	Adenocarcinoma (abdominal)	Gentz et al. <sup>9</sup>
19	M	–	Adenocarcinoma (duodenal)/splenic erythroid leukemia	Canfield et al. <sup>15</sup>
20	M	A	Splenic erythroid leukemia	Canfield et al. <sup>15</sup>
21	M	A	Splenic erythroid leukemia	Canfield et al. <sup>15</sup>
22	–	–	Splenic erythroid leukemia	Gentz et al. <sup>9</sup>
23	M	–	Lymphoid or myeloid leukemia	Canfield et al. <sup>15</sup>
24	M	11	Fibroma	Gentz et al. <sup>9</sup>
25	–	–	Fibroma (subcutaneous)	Canfield et al. <sup>15</sup>
26	–	–	Fibroma (subcutaneous)	Canfield et al. <sup>15</sup>
27	M	1	Fibrosarcoma (incidental)	Gentz et al. <sup>9</sup>
28	M	11	Fibrosarcoma/lymphosarcoma	Gentz et al. <sup>9</sup>
29	F	12	Lymphosarcoma	Gentz et al. <sup>9</sup>
30	M	8	Lymphosarcoma	Gentz et al. <sup>9</sup>
31	M	7	Lymphosarcoma	Gentz et al. <sup>9</sup>
32	M	4	Lymphosarcoma (cutaneous)	Hough et al. <sup>5</sup>
33	M	12	Lymphosarcoma (cutaneous)	Gentz et al. <sup>9</sup>
34	M	11	Myxosarcoma	Gentz et al. <sup>9</sup>
35	F	11	Hemangiosarcoma (dermal)	SDZ <sup>d</sup>
36	F	7	Histiocytoma (subcutaneous)	Gentz et al. <sup>9</sup>
37	–	–	Melanoma (cutaneous)	Garner <sup>8</sup>
38	–	–	Melanoma (cutaneous)	Garner <sup>8</sup>
39	F	5	Pheochromocytoma	Gentz et al. <sup>9</sup>
40	M	4	Sebaceous epithelioma	Gentz et al. <sup>9</sup>
41	F	1	Dysgerminoma	Gentz et al. <sup>9</sup>
42	M	11	Spindle cell tumor	Gentz et al. <sup>9</sup>
43	M	7	Pericloacal tumor	Gentz et al. <sup>9</sup>
44	–	–	Hepatocellular tumor (malignant)	Garner <sup>8</sup>
45	–	–	Hepatocellular tumor (malignant)	Garner <sup>8</sup>
46	–	–	Hepatocellular tumor (malignant)	Garner <sup>8</sup>
47	–	–	Hepatocellular tumor (benign)	Garner <sup>8</sup>
48	–	–	Hepatocellular tumor (benign)	Garner <sup>8</sup>
49	–	–	Scent gland tumor (benign)	Garner <sup>8</sup>
50	–	–	Scent gland tumor (benign)	Garner <sup>8</sup>

<sup>a</sup>Age is reported in years.<sup>b</sup>Information was not reported in original source.<sup>c</sup>Age was reported as adult.<sup>d</sup>From San Diego Zoo.

visceral hemangiosarcomas are typified by very aggressive biologic behavior with rapid and widespread metastasis, possibly owing to their close association with the tumor vasculature.<sup>10-12</sup> Despite the large blood vessels in close proximity to the tumor in this case, histopathologic examination indicated there were no neoplastic infiltrates in the vessel walls. It is thought that the animal care staff's early recognition of the lesion, combined with complete excision shortly following the original diagnosis, prevented tumor spread.

Hemangiosarcoma is considered a common neoplasm in domestic dogs but rare in domestic cats.<sup>12</sup> In marsupials, documented cases of spontaneous hemangiosarcoma are limited to an eastern barred bandicoot that was diagnosed with disseminated hemangiosarcoma.<sup>13</sup> There is also a report of a rufous bettong with vasoformative proliferation in the spleen and liver that produced clinical pathologic findings typically associated with hemangiosarcoma (anemia with schizocytes and acanthocytes).<sup>14</sup>

To the authors' knowledge, this is the first case of dermal hemangiosarcoma reported in a sugar glider. Overall, tumors of the skin and subcutaneous tissue appear to be common in this species and should be included in a differential in sugar gliders with enlarging cutaneous, dermal, or subcutaneous lesions.

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